

MEMOIRS
OF THE
GEOLOGICAL SURVEY
OF
THE UNITED KINGDOM.

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*Figures and Descriptions*

ILLUSTRATIVE OF  
BRITISH ORGANIC REMAINS.

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DECADE V.  
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BRITISH FOSSILS.

DECADE THE FIFTH.

IN apologizing for the unavoidable delay which has taken place in the publication of this Decade, owing to the much lamented decease of Professor Edward Forbes, it is right to state that the materials left behind by him were scanty, and had been unfortunately mislaid a short time before his death. The first description only, that of *Solaster Moretonis*, had been fully written by him; of the others, we had here and there notes on the distinctive characters of the species, and of his views as to their synonymy or history. The plates, however, had been all engraved under his own eye, and the specific designations under which he wished the figures to stand, were recorded in the last edition of Morris's Catalogue. He had there also applied MS. names to a number of species to be described in the Decade.

In a few cases only it has been found necessary to alter some of these names; and this has been done in deference to an authority which would have been gladly admitted by Professor Forbes. To Mr. S. P. Woodward, of the British Museum, we are indebted for all the notes respecting these supplementary species; and he has also furnished full descriptions of three of the plates. With this valuable aid, and the friendly communications of Dr. T. Wright, of Cheltenham, we can present the Decade in nearly as complete a form as it would have possessed had our friend and Master lived to finish it. We miss, however, his lively remembrance of the living species, and his practical acquaintance with their variations,—deficiencies not to be supplied by reference to his published works.

Of the ten species figured three are new,—*Solaster Moretonis*, *Cidaris Carteri*, and *Pygaster conoideus*. Of the other genera, *Diadema*, *Echinopsis*, and *Echinus* present us with well-known types from the Oolitic rocks, which are continental as well as British. *Pyrina* is a rare genus in England, and in this, and the two figured species of *Pygaster*, we have excellent examples of that division of the *Cassidulidae* in which the ambulacra are of uniform character throughout. Several genera of this type have been figured in the Decades. The *Pygaster semisulcatus* is a critical species, and its synonymy is now for the first time cleared up. *Hemiaster Murchisonia* is another instance of the same kind, and belongs to a large genus of closely allied species. The *Brissus Scillæ* is a Crag species still existing in the Mediterranean. None of these nine genera have before appeared in the Decades.

There are engraved plates sufficient for another fasciculus, upon which Professor Forbes left no memoranda, except the names of the species. These Plates will be published at a future period.

JOHN W. SALTER,
Palæontologist.

Geological Survey Office, Jermyn Street, London,
February 1856.

BRITISH FOSSILS.

DECADE V. PLATE III.

ECHINOPSIS ROTATA.

[Genus ECHINOPSIS. AGASSIZ. (Sub-kingdom Radiata. Class Echinodermata. Family Echinidæ.) Body inflated, depressed, or spheroidal ; primary tubercles in each area small, perforated, and borne on plain, not crenulated, bosses ; pores in single file, or in oblique ranks of threes ; mouth but slightly notched.]

[Sub-genus *Pedina*, AGASS. Pores in ranks of threes.]

DIAGNOSIS. *E. sesquiuncialis*, *rotunda vel subpentagona*, *granulosa*, *tuberculis primariis 10-radiatis muricata*, *ambulacralibus distincte binis*, *parvis*; *interambulacrorum (in serie singula 13-14) superne majoribus conspicuis*, *infra arctius aggregatis minoribus*: *secundariis*, *nonnullis ad orem exceptis majoribus, minutis*; *ore modico*.

SYNONYMS. *Pedina rotata*, AGASSIZ (1840), Echin. Suiss., pl. 15. fig. 4-6. *P. ornata*, ib., fig. 7. [*Diadema micrococcon*, DESMOULINS (1837), Tabl. Synon. des Echin., p. 314.] *Pedina rotata*, M'Coy (1848), Ann. Nat. Hist. 2nd ser. vol. ii. p. 210. *P. rotata*, WRIGHT (1851), ib., vol. viii. p. 273. *Echinopsis rotata*, FORBES (1854), in Morris's Catalogue, 2nd edit. p. 78. [*P. granulosa*, AG., Cat. Raisonné (1846), Ann. Sc. Nat., vol. vi. p. 370. *P. Gervillii*, AG., ib., 371. sec. WRIGHT.]

To the excellent description given by Dr. Wright in the eighth volume of the Annals of Natural History, there is scarcely anything to add ; and as that author and Professor Forbes have both abstained from citing their names, we do not feel justified in associating with this species the other very closely allied forms, viz., *P. sublaevis* and *P. aspera*, which Prof. Agassiz had first separated in his Echinod. Suisses, and afterwards, in the Catal. Raisonné, united with *P. rotata*. Nor would it be proper here to raise a question as to the propriety of uniting *Echinopsis* with the genus *Pedina*. The essential character supposed to distinguish the latter genus, viz., having the bosses of the tubercles crenulated, has proved to be a

mistake.* And as Prof. E. Forbes lately published, as an *Echinopsis*, a tertiary species agreeing in all the main characters with *Pedina*, he has in that way distinctly recorded his opinion that the two groups should form but one genus.

Description.—Diameter, an inch and a quarter; height, three-quarters of an inch. "The test of this urchin is circular, but in some specimens a fullness of the ambulacral areæ gives it a slightly pentagonal outline; it is particularly tumid at the circumference, and depressed at both poles. The ambulacral areæ have two rows of small tubercles disposed along their outer border, between which rows small granules are arranged with less regularity. The interambulacral areæ are twice and a half the width of the ambulacral, and furnished each with a double range of primary tubercles, extending from the mouth to the ovarian plates." These primaries are prominent, and give a rough character to the upper surface, where they are larger and less crowded than on the lower. They radiate in ten conspicuous rows, each pair of rows about 30° apart, and on each side of them are very irregular secondary rows, and numerous miliary granules, which surround the areolæ and cover the whole surface. In a very good specimen, lent us by Dr. Wright, there are thirteen plates in an interambulacral row. In the upper ones the length is equal to the breadth, but its proportion decreases towards the periphery, on which the plates are nearly three times as broad as they are long (fig. 4). Each plate bears a perforated primary tubercle, which is placed on a small smooth boss near the lower margin, and, besides, seven or eight much smaller secondary tubercles, perforated and surrounded by the granules. The tubercles on the ambulacral areæ are no larger than the secondaries on the other portions. They are numerous, about thirty-three or thirty-four in a row, perforate, and all of nearly equal size. One or two are here and there larger than the others, but not in any regular order.

"The poriferous avenues are narrow, in which the holes are thickly set in triple oblique pairs," more oblique above (see fig. 4.) than on the under surface, where the threes are so placed that the pairs appear to be alternately 1, 2, 1, 2, the lowermost of the three coming into line with the uppermost of the next rank, and the middle one

* In the typical group, represented by *Ech. elegans*, the pores are not arranged in triple rows; and if to this be added the small size of the genital plates, (which, with the oculars, form a sort of ring round a large anal aperture,) and the very slight indentations of the edge of the mouth, there would seem to be good reason for separating from them *Pedina*, which has triple ranks of pores, and for making the latter a sub-genus at least.

standing by itself. Each pair is distinctly surrounded by an oval ring, which disappears when the surface is abraded.

The mouth is small, and does not occupy more than a third of the diameter, even including the short notches. These are ten in number, and not far from equidistant; the pair beneath the ambulacral spaces, however, are placed closer to each other than to the next pair: the oral margin between the notches is straight, not rounded.

The apical disk is often well preserved, probably from its shape. It is small, of five nearly equal heptagonal plates, the blunt points of which form re-entering angles upon the interambulacral space, and the madreporic plate is scarcely at all larger than the others. Between these are five moderately large oculars of pentagonal form, and these, as well as the genital plates, have the perforation placed outside the middle of the plate. The anal aperture is scarcely wider than one of the genital plates; it is more angular than in our figures.

Affinities.—Between our British fossil and Agassiz's description and figure of the *P. rotata* there seems to be a very close similarity. Perhaps the figure in the Ech. Suisses may represent a species with more numerous interambulacral plates on the upper half, but it agrees with ours in the tumid form, the shape of the ambulacral areæ, and their close-set and equal tubercles. The latter character we think will justify the union of *P. ornata*, Ag., with it, but will at once separate *P. rotata* from the *P. sublaevis* or *P. aspera*, Ag., in which only every third or fourth of these tubercles is enlarged, so that there is a zig-zag row of conspicuous tubercles down the area, instead of the close-set double series of small ones. Added to this, the two Swiss species just quoted are decidedly more depressed than *P. rotata*, and the secondary tubercles, instead of being scattered, are arranged in intermediate rows on the interambulacra.

History.—M. Agassiz quotes in his Catal. Rais. the name of *Diadema micrococcon* of Desmoulins for this species. As that author published his Tableau Synonymique des Echinides in 1835,* this name would have priority, had his short description, unaccompanied by figure or locality, been sufficient to recognize the species. It was well figured, but scarcely sufficiently described in the Ech. Suisses, where the more equal character of the ambulacral tubercles and the greater height of the test are shown in contrast with the depressed form of *P. sublaevis*, Ag. But in the Catalogue Rais.

* Actes de la Soc. Linn. de Bordeaux, tom. 7,

the author seems to have doubted the propriety of separating these closely allied species, and he has accordingly thrown together not only the *P. rotata* and the *P. ornata*, in which view we think the English specimens will bear him out, but also the more flattened form *P. aspera*, from the oolites of France and Switzerland (Oxfordien, "terrain à chailles"), or, as it appears when partly abraded, *P. sublaevis*.

As explained above, we regard these as distinct, and in this opinion we have the concurrence of Mr. S. P. Woodward in support of what appears to have been the late Prof. E. Forbes' view. More lately (1848) Prof. M'Coy quoted this fossil as from the great oolite of Minchinhampton, probably an error, as Dr. Wright has since pointed out in the careful description above cited. We have seen his specimen at Cambridge, and there is no doubt it is of the same species as ours. Lastly, in a supplementary paper (1854, Ann. and Mag. Nat. Hist., vol. xiii.), Dr. Wright has stated that, having examined the original specimen of Agassiz's, *P. granulosa*, from the great oolite of Ranville, he has convinced himself of their identity with the British species. Specimens also of *P. Gervillii*, Ag., from the original locality, the "Kellovien" rock of Chaffour, Department du Sarthe, communicated by M. Michelin and M. Lorière, "were so entirely like those from the Inferior Oolite of Gloucestershire, that he would have mistaken one for the other had he not previously marked them." The vertical range of this species, then, even if we do not admit its identity with *P. aspera* and *P. sublaevis*, would appear to be considerable.

Localities.—INFERIOR OOLITE. In the upper beds of this formation at Shurdington Hill; CORNBRASE of Rushdon, Northamptonshire. [Dr. WRIGHT.]

Foreign Localities.—TERRAIN JURASS. des environs de Doubs, collected by M. Renard Compté (Agassiz); GREAT OOLITE of Ranville, Calvados; OXFORD CLAY, near Boulogne; KELLOVIEN of Chaffour, Sarthe. [Dr. WRIGHT.]

DESCRIPTION OF THE PLATE.

Fig. 1. Upper surface of a very round specimen of *Echinopsis rotata*, natural size, shewing the anal area and apical disk. (Coll. Geol. Surv.)

Fig. 2. Lateral view, the secondary tubercles are scarcely sufficiently evident in our figure, which is from an abraded specimen.

Fig. 3. Under side, with the small ten-notched mouth.

Fig. 3a. A part of the same magnified.

Fig. 4. A few plates from the upper side of the test, magnified. (Dr. Wright's specimen.)

Fig. 5, 6. A primary tubercle, with its small smooth-edged boss, surrounded by miliary granules. 6, the same seen edgewise.

Fig. 7. The apical disk surrounding the anal space. *a*, perforated genital plate. *b*, that one which bears the madreporiform tubercle. *c*, ocular plate.

J. W. SALTER.

March 1856.

Notes on other British Species.

Prof. E. Forbes has left in MS. the following account of a large species of this genus in William Smith's collection, preserved in the British Museum:—

1. *Ech. Smithii*. Forbes, sp. nov. [*Cidaris*, sp. 2. of William Smith's Strat. System, p. 109.]

E. biuncialis pentagona depressa, superne granulosa tuberculisque magnis bifariis late divaricatis instructa: subtus tuberculis quadrifariis, magnis, omnibus etiam ambulacralibus primaria fere æquantibus: ore profunde inciso.

“Pentangular depressed, with projecting and rather distant small mamillæ; two contiguous rows in each areola, and four converging rows in each area, the two middle rows short, and only on the side or widest part of the area: rough, with small points encircling the mamillæ; rays obliquely triporous.

“The areolæ form the angles of the pentagon. The two larger rows of mamillæ in each area are parallel to the rays, and converge to the aperture, and the space between them on the side is occupied by two shorter converging rows.

“*Locality*.—Tucking Mill.”

“The above is the description given by William Smith of a fossil from the under Oolite, to the original of which, preserved in the British Museum, my attention has been kindly directed by Mr. Woodward. Tucking Mill is in Moreton Combe, S.E. of Bath, and the beds from which this urchin came probably belong to the Coral Rag.

“The specimen is a fine fragment, exhibiting two interambulacral and an ambulacral area. The disk is broken away, but the notches of one angle of the mouth are exposed; they are deep, and have reflected edges. The tubercles on the ambulacral area, which is very narrow, closely alternate, and are smaller* than those on the interambulacrals. The inferior interambulacral plates bear, towards the periphery (and below it), two tubercles each: the superior ones bear only one each, and that towards their outer margin. The tubercles are deeply perforated. The boss is elevated and smooth-edged, with a deeply channelled summit, and with a distinct flattened areola at its base. The intermediate spaces between the two rows of primaries above, and among the large tubercles on the under surface, are occupied by very small perforated secondary tubercles with areolæ, and with granules round them. The diameter of the test was nearly two inches, and the height about one inch. The pores are arranged in three ranks, and become close and crowded below.”

E. F.

* They are so, but on the under surface are unusually large, and to the eye appear equally conspicuous with the primaries. This appearance has therefore been adverted to in the diagnosis. On the upper half of the superior face they abruptly cease.—J. W. S.

2. There is another species in the Inferior Oolite of Crickley nearly of the size of the *E. Smithii*, but more convex above, and with the pores in much more oblique rows. (Dr. Wright's Collection.)

3. *E. Bakeri*. (*Pedina*, Wright, 1854, in Ann. Nat. Hist., vol. xiii, pl. 11. fig. 4. *Hemipedina Bakeri*, ib. (1855), vol. xvi. p. 97.) *an præcedentis (E. Smithii) junior?*

A small species, much resembling the *Ech. Smithii*. The round contour, and the ten nearly equal distant rows of primary tubercles, will well distinguish it at present. The pores being arranged nearly in single file on the upper portion might be only a character derived from difference of age.

Locality.—INFERIOR OOLITE. Crickley Hill and Leckhampton, Gloucestershire. [Dr. Wright.]

One species of this section has been described from the British Tertiaries. It is—

4. *E. Edwardsii*, Forbes, Monog. Ech. Brit. Tert., Palæont. Soc. (1852), pl. 3. f. 2. Morris's Catal., 2nd edit. p. 78.

A small neat species, not half an inch broad, with narrow ambulacra, which have prominent tubercles except quite at the top, and crowded pores, the arrangement of which is such that instead of falling into ranks of threes, descending obliquely from the ambulacra outwards, they form ranks oblique in the other direction, viz., towards the ambulacrum. It is an unusual arrangement, and may be useful as a specific character. From this position of the pores the avenues are broad, and deducting these, the interambulacral spaces are not above twice as broad as the others ("three times," Forbes), and the tubercles are larger, less closely placed (about eight from the apex to the periphery), and nearly of equal size all the way up, while the ambulacral ones fail suddenly, and become mere granules at the upper part. The figure in the Pal. Monograph. does not express this character perfectly. The surface is granulated, and there are secondary tubercles as well as granules on the interambulacra, which are only smooth down the suture.

Locality.—LONDON CLAY. Bracklesham Bay, Sussex. (Mus. Pract. Geol.)

J. W. S.

Notes on Echinopsis, by S. P. Woodward, Esq.

In the second edition of Morris's Catalogue, p. 78, four species of *Echinopsis* are enumerated, viz.:—

E. Edwardsii, Forbes.

E. pusilla, Rømer.

E. rotata, Agassiz.

E. Smithii, Forbes.

Of these, *E. rotata* and *E. Smithii* fall into the sub-generic division *Pedina* of Agassiz. *E. pusilla* was erroneously referred to the group; it is probably identical with *Ech. radiatus* (Høeningh.), and is known in France by the name of *Temnopleurus pulchellus* (Sorignet, Oursins foss. de l'Eure, p. 31). It is the type of M. Haime's proposed new genus *Glyphocyphus* (D'Archiac and Haime's Foss. de l'Inde, I., p. 202. Desor, Syn., p. 102.)

E. Edwardsii agrees with *Pedina* in the character formerly supposed to be essential, viz., the arrangement of the pores in threes; but in his new synopsis, M. Desor places with *Echinopsis* the Tertiary species (*E. Gacheti*), in which, as in *E. Edwardsii*, the pores are tripled.

Since the publication of Morris's Catalogue, Dr. Wright has described no less than fifteen additional species from the English Oolites, in which the pores are more or less in single file. To these he has given the name *Hemipedina* (Ann. Nat. Hist., August, 1855), whilst M. Desor has proposed the name *Diademopsis* for the same group, in the second part of his Synopsis, p. 79. Some of the species appear, too, to have been described by him under other names:—

Lias Species.

5. *Hemipedina Bechei* (*Cidaris*), Brod.
Locality.—LIAS of Lyme Regis. (Mus. Geol. Society.)
6. *H. Bowerbankii*, Wr.
Locality.—Lyme Regis. (Coll. Mr. Bowerbank.)
7. *H. Jardinii*, Wr.
Locality.—Ilminster (Mr. Moore). Bredon (Mr. Strickland).
8. *H. Etheridgii* (*Pedina*), Wr.
Hypodiadema Etheridgii, Desor, Syn., p. 61.
Locality.—Ilminster (Mr. Moore).

Inferior Oolite.

Hemipedina Bakeri, Wright. This species is a true *Pedina*, having the pores in threes (see above); M. Desor has unfortunately placed it with *Hemicidaris stramonium*, in his very ambiguous genus "*Hemidiadema*," Syn. Ech., p. 57.

- Locality*.—Crickley, Dr. Wright.
9. *H. perforata* (*Goniopygus*?), Wr.
 Same locality.
 10. *H. tetragramma*, Wr.
 Same locality.
 11. *H. Waterhousei*, Wr.
 Same locality.
 12. *H. Bonei*, Wr.
 Same locality.

Great Oolite and Cornbrash.

13. *H. Davidsoni*, Wr.
Locality.—Minchinhampton.
14. *H. Woodwardi*, Wr.
Locality.—Wilts (Dr. Wm. Smith), Dr. Wright. Marquise, near Boulogne. (Brit. Mus.)

Coral Rag.

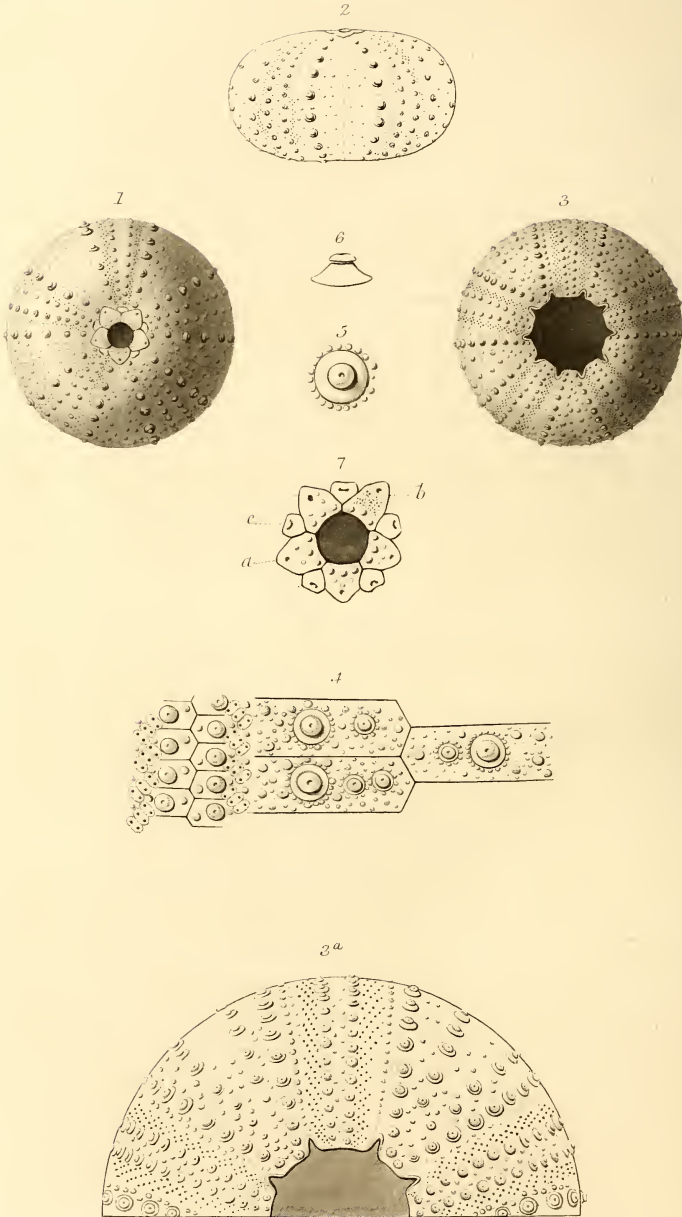
15. *H. tuberculosa*, Wr. This appears to be the *Hemicidaris depressa* of Ag., Cat. 9.
Locality.—Lyneham (Wm. Buy). Brit. Mus.
16. *H. Marchamensis*, Wr.
Locality.—Marcham, Berks. (Coll. Hon. R. Marsham.)

Kimmeridge Clay.

17. *H. Morrisii*, Wr.
Locality.—Aylesbury. (Z. Hunt, Esq.)
18. *H. Cunningtoni*, Wr.
 Same locality and collection

S. P. WOODWARD.

March 1856.



ECHINOPSIS (PELINA) ROTATA — *Agassiz.*